

APPENDIX B TO PART 434—BASELINE DETERMINATION AND COMPLIANCE MONITORING FOR PRE-EXISTING DISCHARGES AT REMINING OPERATIONS

I. GENERAL PROCEDURE REQUIREMENTS

a. This appendix presents the procedures to be used for establishing effluent limitations for pre-existing discharges at coal remining operations, in accordance with the requirements set forth in subpart G; Coal Remining. The requirements specify that pollutant loadings of total iron, total manganese, total suspended solids, and net acidity in pre-existing discharges shall not exceed baseline pollutant loadings. The procedures described in this appendix shall be used for determining site-specific, baseline pollutant loadings, and for determining whether discharge loadings during coal remining operations have exceeded the baseline loading. Both a monthly (single-observation) procedure and an annual procedure shall be applied, as described below.

b. In order to sufficiently characterize pollutant loadings during baseline determination and during each annual monitoring period, it is required that at least one sample result be obtained per month for a period of 12 months.

c. Calculations described in this appendix must be applied to pollutant loadings. Each loading value is calculated as the product of a flow measurement and pollutant concentration taken on the same date at the same discharge sampling point, using standard units of flow and concentration (to be determined by the permitting authority). For example, flow may be measured in cubic feet per second, concentration in milligrams per liter, and the pollutant loading could be calculated in pounds per year.

d. Accommodating Data Below the Maximum Daily Limit at subpart C of this part. In the event that a pollutant concentration in the data used to determine baseline is lower than the daily maximum limitation established in subpart C of this part for active mine wastewater, the statistical procedures should not establish a baseline more stringent than the BPT and BAT effluent standards established in subpart C of this part. Therefore, if the total iron concentration in a baseline sample is below 7.0 mg/L, or the total manganese concentration is below 4.0 mg/L, the baseline sample concentration may be replaced with 7.0 mg/L and 4.0 mg/L, respectively, for the purposes of some of the statistical calculations in this appendix B. The substituted values should be used for all methods in this appendix B with the exception of the calculation of the interquartile range (R) in Method 1 for the annual trigger (Step 3), and in Method 2 for the single observation trigger (Step 3). The interquartile range (R) is the difference between

the quartiles M_{-1} and M_1 ; these values should be calculated using actual loadings (based on measured concentrations) when they are used to calculate R. This should be done in order to account for the full range of variability in the data.

II. PROCEDURE FOR CALCULATING AND APPLYING A SINGLE-OBSERVATION (MONTHLY) TRIGGER

Two alternative methods are provided for calculating a single-observation trigger. One method must be selected and applied by the permitting authority for any given remining permit.

A. Method 1 for Calculating a Single Observation Trigger (L)

(1) Count the number of baseline observations taken for the pollutant of interest. Label this number n. In order to sufficiently characterize pollutant loadings during baseline determination and during each annual monitoring period, it is required that at least one sample result be obtained per month for a period of 12 months.

(2) Order all baseline loading observations from lowest to highest. Let the lowest number (minimum) be $x_{(1)}$, the next lowest be $x_{(2)}$, and so forth until the highest number (maximum) is $x_{(n)}$.

(3) If fewer than 17 baseline observations were obtained, then the single observation trigger (L) will equal the maximum of the baseline observations ($x_{(n)}$).

(4) If at least 17 baseline observations were obtained, calculate the median (M) of all baseline observations:

Instructions for calculation of a median of n observations:

If n is odd, then M equals $x_{(n/2 + 1/2)}$.

For example, if there are 17 observations, then $M = X_{(17/2 + 1/2)} = x_{(9)}$, the 9th highest observation.

If n is even, then M equals $0.5 * (x_{(n/2)} + x_{(n/2 + 1)})$.

For example, if there are 18 observations, then M equals 0.5 multiplied by the sum of the 9th and 10th highest observations.

(a) Next, calculate M_1 as the median of the subset of observations that range from the calculated M to the maximum $x_{(n)}$; that is, calculate the median of all x larger than or equal to M.

(b) Next, calculate M_2 as the median of the subset of observations that range from the calculated M_1 to $x_{(n)}$; that is, calculate the median of all x larger than or equal to M_1 .

(c) Next, calculate M_3 as the median of the subset of observations that range from the calculated M_2 to $x_{(n)}$; that is, calculate the median of all x larger than or equal to M_2 .

(d) Finally, calculate the single observation trigger (L) as the median of the subset of observations that range from the calculated M_3 to $x_{(n)}$.

NOTE: When subsetting the data for each of steps 3a-3d, the subset should include all observations greater than or equal to the median calculated in the previous step. If the median calculated in the previous step is not an actual observation, it is not included in the new subset of observations. The new median value will then be calculated using the median procedure, based on whether the number of points in the subset is odd or even.

(5) Method for applying the single observation trigger (L) to determine when the baseline level has been exceeded

If two successive monthly monitoring observations both exceed L, immediately begin weekly monitoring for four weeks (four weekly samples).

(a) If three or fewer of the weekly observations exceed L, resume monthly monitoring

(b) If all four weekly observations exceed L, the baseline pollution loading has been exceeded.

B. Method 2 for Calculating a Single Observation Trigger (L)

(1) Follow Method 1 above to obtain M_1 (the third quartile, that is, the 75th percentile).

(2) Calculate M_{-1} as the median of the baseline data which are less than or equal to the sample median M .

(3) Calculate interquartile range, $R = (M_1 - M_{-1})$.

(4) Calculate the single observation trigger L as

$$L = M_1 + 3 * R$$

(5) If two successive monthly monitoring observations both exceed L, immediately begin weekly monitoring for four weeks (four weekly samples).

(a) If three or fewer of the weekly observations exceed L, resume monthly monitoring

(b) If all four weekly observations exceed L, the baseline pollution loading has been exceeded.

III. PROCEDURE FOR CALCULATING AND APPLYING AN ANNUAL TRIGGER

A. Method 1 for Calculating and Applying an Annual Trigger (T)

(1) Calculate M and M_1 of the baseline loading data as described above under Method 1 for the single observation trigger.

(2) Calculate M_{-1} as the median of the baseline data which are less than or equal to the sample median M .

(3) Calculate the interquartile range, $R = (M_1 - M_{-1})$.

(4) The annual trigger for baseline (T_b) is calculated as:

$$T_b = M + \frac{(1.815 * R)}{\sqrt{n}}$$

where n is the number of baseline loading observations.

(5) To compare baseline loading data to observations from the annual monitoring period, repeat steps 1-3 for the set of monitoring observations. Label the results of the calculations M' and R' . Let m be the number of monitoring observations.

(6) The subtle trigger (T_m) of the monitoring data is calculated as:

$$T_m = M' - \frac{(1.815 * R')}{\sqrt{m}}$$

(7) If $T_m > T_b$, the median loading of the monitoring observations has exceeded the baseline loading.

B. Method 2 for Calculating and Applying an Annual Trigger (T)

Method 2 applies the Wilcoxon-Mann-Whitney test to determine whether the median loading of the monitoring observations has exceeded the baseline median. No baseline value T is calculated.

(1) Steps for Conducting the Wilcoxon-Mann-Whitney Test

(a) Let n be the number of baseline loading observations taken, and let m be the number of monitoring loading observations taken. In order to sufficiently characterize pollutant loadings during baseline determination and during each annual monitoring period, it is required that at least one sample result be obtained per month for a period of 12 months.

(b) Order the combined baseline and monitoring observations from smallest to largest.

(c) Assign a rank to each observation based on the assigned order: the smallest observation will have rank 1, the next smallest will have rank 2, and so forth, up to the highest observation, which will have rank $n + m$.

(1) If two or more observations are tied (have the same value), then the average rank for those observations should be used. For example, suppose the following four values are being ranked:

3, 4, 6, 4

Since 3 is the lowest of the four numbers, it would be assigned a rank of 1. The highest of the four numbers is 6, and would be assigned a rank of 4. The other two numbers are both 4. Rather than assign one a rank of 2 and the other a rank of 3, the average of 2 and 3 (i.e., 2.5) is given to both numbers.

(d) Sum all the assigned ranks of the n baseline observations, and let this sum be S_n .

(e) Obtain the critical value (C) from Table 1. When 12 monthly data are available for both baseline and monitoring (i.e., $n = 12$ and $m = 12$), the critical value C is 99.

(f) Compare C to S_n . If S_n is less than C, then the monitoring loadings have exceeded the baseline loadings.

(2) Example Calculations for the Wilcoxon-Mann-Whitney Test

BASELINE DATA											
8.0	9.0	9.0	10.0	12.0	15.0	17.0	18.0	21.0	23.0	28.0	30.0
MONITORING DATA											
9.0	10.0	11.0	12.0	13.0	14.0	16.0	18.0	20.0	24.0	29.0	31.0
BASELINE RANKS											
1.0	3.0	3.0	5.5	8.5	12.0	14.0	15.5	18.0	19.0	21.0	23.0
MONITORING RANKS											
3.0	5.5	7.0	8.5	10.0	11.0	13.0	15.5	17.0	20.0	22.0	24.0

SUM OF RANKS FOR BASELINE IS $SN = 143.5$, CRITICAL VALUE IS $C_{n,m} = 99$.

(3) Critical Values for the Wilcoxon-Mann-Whitney Test

(a) When n and m are less than 21, use Table 1.In order to find the appropriate critical value, match column with correct n (number of baseline observations) to row with correct m (number of monitoring observations)*.TABLE 1—CRITICAL VALUES (C) OF THE WILCOXON-MANN-WHITNEY TEST
(for a one-sided test at the 0.001 significance level)

n m	10	11	12	13	14	15	16	17	18	19	20
10	66	79	93	109	125	142	160	179	199	220	243
11	68	82	96	112	128	145	164	183	204	225	248
12	70	84	99	115	131	149	168	188	209	231	253
13	73	87	102	118	135	153	172	192	214	236	259
14	75	89	104	121	138	157	176	197	218	241	265
15	77	91	107	124	142	161	180	201	223	246	270
16	79	94	110	127	145	164	185	206	228	251	276
17	81	96	113	130	149	168	189	211	233	257	281
18	83	99	116	134	152	172	193	215	238	262	287
19	85	101	119	137	156	176	197	220	243	268	293
20	88	104	121	140	160	180	202	224	248	273	299

(b) When n or m is greater than 20 and there are few ties, calculate an approximate critical value using the following formulaand round the result to the next larger integer. Let $N = n + m$.

$$\text{CriticalValue} = 0.5 * n * (N + 1) - 3.0902 * \sqrt{n * m (N + 1) / 12}$$

For example, this calculation provides a result of 295.76 for $n = m = 20$, and a result of 96.476 for $n = m = 12$. Rounding up produces approximate critical values of 296 and 97.(c) When n or m is greater than 20 and there are many ties, calculate an approximate critical value using the following formula and round the result to the next larger

integer. Let S be the sum of the squares of the ranks or average ranks of all N observations. Let $N = n + m$.

$$\text{CriticalValue} = 0.5 * n * (N + 1) - 3.0902 * \sqrt{V}$$

In the preceding formula, calculate V using

$$V = \frac{n * m * S}{N * (N - 1)} - \frac{n * m * (N + 1)^2}{4 * (N - 1)}$$

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PART 435—OIL AND GAS EXTRACTION POINT SOURCE CATEGORY

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435.12 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available (BPT).

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APPENDIX 1 TO SUBPART A OF PART 435—STATIC SHEEN TEST (EPA METHOD 1617)

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APPENDIX 6 TO SUBPART A OF PART 435—REVERSE PHASE EXTRACTION (RPE) METHOD FOR DETECTION OF OIL CONTAMINATION IN NON-AQUEOUS DRILLING FLUIDS (NAF) (GC/MS) (EPA METHOD 1670)

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Subpart B [Reserved]

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435.45 Standards of performance for new sources (NSPS).

435.46 Pretreatment standards of performance for existing sources (PSES).

435.47 Pretreatment standards of performance for new sources (PSNS).

APPENDIX 1 TO SUBPART D OF PART 435—PROCEDURE FOR DETERMINING WHEN COASTAL